



## INSTRUCTIONS

GEK-26431A  
Supersedes GEK-26431

VOLTAGE MATCHING RELAY  
SASB11A AND SASB11B RELAY

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GENERAL  ELECTRIC

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**TYPE SASB11**  
**STATIC VOLTAGE MATCHING RELAY**  
**TYPES SASB11A AND SASB11B**

**DESCRIPTION**

The Type SASB relays are static voltage matching relays used as an auxiliary with generator automatic synchronizing equipments such as the Type GES relay. The SASB is designed to raise or lower the generator voltage so as to match the bus voltage before a synchronizing attempt is made. The relay consists of a very sensitive polarized unit, (S), four telephone type relay units (R, L, V and X), two input transformers, and the necessary solid state logic circuitry all mounted in a standard size M2 drawout case. Only one relay is necessary to match the voltage for a given generator to be synchronized. This relay can be switched to the control of another generator just as is usually done with the usual complement of automatic synchronizing equipment.

**APPLICATION**

The Type SASB voltage matching relay is applied to match an AC generator terminal voltage to a bus voltage prior to permitting the synchronizing of the generator to that bus. The relay is energized simultaneously with both the generator and the bus voltage. The solid state logic circuitry compares these voltages and provides the proper operation of the output relay units. The relay output contacts in turn control the raise or lower circuits of the generator voltage adjusting rheostat and thereby change the generator terminal voltage. The Type SASB11A relay is applied with amplidyne or Type GDA voltage regulators which operate to control the generator voltage very closely in accordance with the movement of the voltage adjusting rheostat. For other types of voltage regulators which do not have such a rapid and precise response, the Type SASB11B relay is applied. This latter relay is provided with additional logic circuitry so as to pulse the output voltage changing control circuits instead of providing a continuous output signal. The SASB11A relay is easily converted to the SASB11B relay by the insertion of a printed circuit card containing the necessary solid state circuitry. Refer to the internal connections of Fig. 2 and the external connections of Fig. 3.

The relay circuits provide the following features of control and adjustment:

1. The voltage detecting circuits permit relay operation only when both the bus and the generator voltages are above a preselected level. This prevents matching the generator voltage to an abnormally low bus voltage. Both the bus and the generator voltage detecting levels are independently adjustable over the ranges of 50 to 110 percent of relay rating. The voltage level detector settings are made with resistors R3 (bus) and R11 (generator).

*These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.*

*To the extent required the products described herein meet applicable ANSI, IEEE and NEMA standards; but no such assurance is given with respect to local codes and ordinances because they vary greatly.*

2. The relay will permit synchronizing of the generator to the bus only when the difference voltage falls with a preselected dead band of voltage where no voltage changing outputs are given. This dead band of voltage is adjustable over the range of two to 12 volts by means of resistor R7.

3. The location of the voltage dead band of Item 2 above is adjustable. The band can be centered on bus voltage or it can be centered on any point between 15 volts above and 15 volts below bus voltage by means of resistors R6 and R8. These settings must be within the limits established by the settings as described in Item 1 above.

4. When the Type SASB11B is used, it has an additional voltage level detector setting for starting the pulsing of the raise or lower output signals. This is set by means of R21. The on and off timing of the pulses is also independently adjustable. R22 controls the ON time and R23 controls the OFF time.

Refer to the section titled **ELECTRICAL TESTS AND ADJUSTMENTS** for a description of how to make the above described settings.

**RATING**

The SASB11A and SASB11B relays are available with 120 volt 50/60 cycle rating. Other voltage ratings can be supplied upon request.

**BURDENS**

The burdens on both the bus and generator supply are 6.0 volt amperes at unity power factor. If only one voltage supply is connected to the SASB relay, the burdens will increase on that source by approximately 80 percent.

The relay contacts will carry one ampere continuously and will interrupt the currents given in Table A.

TABLE A

	<u>Current Inductive **</u>	<u>Current Non-Inductive</u>
48 VDC	1.0	3.0
125 VDC	0.5	1.5
250 VDC	0.25	0.75

\*\*Induction of average trip coil

The SASB will operate in ambient temperatures of -20°C to 60°C with maximum variation plus or minus five percent.

## CHARACTERISTICS

The bus voltage detecting circuit, shown in Fig. 3, determines the minimum bus voltage at which the SASB11E relay will operate. This voltage detecting circuit consists of a fixed resistor, an adjusting rheostat, one positioning zener and a detecting transistor (Q3 on Fig. 3). A regulated DC control voltage to operate the static components is supplied from the AC bus supply. The rheostat permits adjusting the minimum bus operating voltage at any point between 60 and 120. The zener regulator provides a close differential voltage detection unit with a dropout of about 99 percent of pickup.

If the SASB11 is energized when the bus voltage is below the Q3 operating voltage setting, then no output signals will be given and synchronizing will be blocked, since the "X" relay cannot pick up. If the SASB11 is energized when the bus voltage is high enough to turn on Q3 and Q13, then it will match the generator voltage to the bus voltage. The SASB11 will permit synchronizing when this match is within the limits set by the relay. If the bus voltage drops below the Q3 setting, it will turn off the SASB11 by dropping out the "X" relay. In a similar manner, the voltage of the generator is checked to be sure it is above the selected limit before any output voltage changing signals are given or synchronizing is permitted.

For example, if the AC generator voltage is ten percent below the AC bus voltage, then the instantaneous voltage difference between these voltages will be anything from 10 percent and 190 percent depending on the point on the slip cycle at which the measurements are taken. To eliminate this variation, both AC supplies are rectified and adequately filtered to provide a solid DC voltage proportional to the AC source. Then the two DC voltages are compared by means of a very sensitive unit. This detecting unit must be capable of standing full voltage since the SASB can be turned on when the generator voltage is zero. The detecting unit (shown as S in Fig. 3) operates a single-pole double-throw contact. This contact is normally open and operates in one direction or the other depending upon the direction of current flowing through its coils. These sensitive relay contacts turns on transistors (Q1 or Q2) to operate one or the other of two telephone type relays indicated as R and L on Fig. 3.

When the SASB is turned on with normal bus voltage (120 volts) and with a generator voltage above the PU settings of Q4 (by means of R11 rheostat), then Q3, Q13, Q4 and Q14 turn on. Also current flows through the S unit coils causing it to close its SR contact which turns on transistor Q2. This picks up relay R. Since Q3, Q13, Q4 and Q14 pick up the "X" unit, which picks up the "V" unit, this provides two raise signals to the voltage adjusting rheostat control circuits. When the generator voltage reaches a value where it reduces the current in the S unit coil below its pickup, then the SR contact opens turning off Q2, which drops out the R relay. This completes the synchronizing circuit since the "X" unit will be picked up. The rheostats R6 and R8 permit adjusting the balance point at which the SR contact opens.

The SASB can be set to open its SR contact and drop out the R relay when the generator voltage equals the bus voltage or at any point 15 volts below or above this voltage. If the generator voltage continues to rise, the current flowing in the S unit coils will reverse and when this current reaches a certain level then the SL contact will make, turning on transistor Q1 and picking up the L relay. This will provide two signals to the voltage adjusting rheostat control circuit and block synchronizing. The

width of the dead band voltage between the opening of the SR and the closing of the SL contact is determined by the amount of current permitted to flow in the S coils. This can be adjusted by rheostat R7 to provide a dead band width of two to 12 volts.

The SASB11B1A relay contains a printed circuit card to provide intermittent voltage changing signals. All SASB relays contain the resistors R13 and R14 and a socket wired for the pulsing printed circuit card. The three rheostats and all other components required for the pulsing controls are mounted on the printed circuit card and an SASB11A1A relay can be changed to a SASB11B1A by simply inserting this pulsing card and moving the lead on terminal 9 to terminal 10. The pulsing card contains a voltage level detecting circuit (which can be adjusted by rheostat R21) which turns on transistor Q5 when the selected level is reached. When "X" picks up; the C1 capacitor is charged through the R23 rheostat and when its voltage level is high enough, current flows through the base to emitter circuits of Q7 and Q17 and the 7.5 volt zener to minus. This turns on the Q7 and Q17 transistors which pick up the "V" telephone-type relay. Now the normally open "V" contact provides a circuit to charge the C2 capacitor through the R22 rheostat. When the C2 voltage reaches the required level, then Q6 and Q16 turn on. These will have no effect until Q5 and Q15 are turned on. Then the C1 capacitor is discharged and Q7 and Q17 turned off. This drops out "V" with some time delay. The R22 rheostat will adjust the time that "V" is dropped out or the "OFF" time. The R23 rheostat will adjust the time "V" is picked up or the "ON" time. The C2 capacitor is discharged through the diode and the 10K resistor when the "V" unit is dropped out. The zeners regulate the DC voltage across this charging circuit so that the time is not changed by variations in the generator voltage. The pulse can be adjusted from 0.5 to six seconds "ON" time and one to six seconds "OFF" time.

### CONSTRUCTION

The relay components are mounted in a cradle assembly which is latched into a drawout case when the relay is in operation but it can be easily removed when desired. To do this, the relay is first disconnected by removing the connection plugs which complete the electrical connections between the case block and the cradle block. To test the relay in its case these connection plugs can be replaced by test plugs. The cover, which is attached to the front of the relay case, contains an interlock arm which prevents the cover from being replaced until the connection plugs have been inserted.

The relay case is suitable for either semi-flush or surface mounting on all panels up to two inches thick and appropriate hardware is available. However, panel thickness must be indicated on the relay order to insure that proper hardware will be included. For outline and drilling dimensions, see Fig. 6. Every circuit in the drawout case has an auxiliary brush, as shown in Fig. 4 to provide adequate overlap when the connecting plug is withdrawn or inserted. Some circuits are equipped with shorting bars (see Fig. 3) and on these circuits it is especially important that the auxiliary brush makes contact as indicated in Fig. 4 with adequate pressure to prevent the opening of important interlock circuits.

## RECEIVING, HANDLING AND STORAGE

These relays, when not included as part of a control panel will be shipped in cartons designed to protect them against damage. Immediately upon receipt of a relay, examine it for any damage sustained in transit. If injury or damage resulting from rough handling is evident, file a damage claim at once with the transportation company and promptly notify the nearest General Electric Apparatus Sales Office.

Reasonable care should be exercised in unpacking the relay. If the relays are not to be installed immediately, they should be stored in their original cartons in a place that is free from moisture, dust and metallic chips. Foreign matter collected on the outside of the case may find its way inside when the cover is removed, and cause trouble in the operation of the relay.

Also check the nameplate stamping to insure that the model number and the rating of the relay received agree with the requisition. Check the operation manually and check that the contact gap and wipe agree with values given under the section of **ADJUSTMENTS AND INSPECTION**.

## **ADJUSTMENTS AND INSPECTION**

### MECHANICAL CHECK

Before installation, the relay unit should be checked mechanically to see that it operates smoothly and that the contacts are correctly adjusted.

With the relay de-energized each normally open contact should have a gap of 0.010 inch - 0.015 inch. Observe the wipe on each normally closed contact by deflecting the stationary contact member towards the frame. Wipe should be approximately 0.005 inch.

The wipe on each normally open contact should be approximately 0.005 inch. This can be checked by inserting an 0.005 inch shim between the residual screw and the pole piece and operating the armature by hand. The normally open contacts should make before the residual screw strikes the shim.

### ELECTRICAL TESTS AND ADJUSTMENTS

The relay should be tested before installation and periodically thereafter by connecting two variable sources of AC voltage to the relay as shown in Fig. 5. The relay should be adjusted by means of the variable resistors to the settings required at its final location (see Fig. 1).

With rated voltage connected to both studs 4 and 5 and 6 and 7 as shown in Fig. 5 the "X" and "V" units will be picked up.

Unless a special setting is requested the R and L units will be dropped out and a circuit will be completed between studs 1 and 3 (or 2) but not between 11 and 12, 13 and 14, 17 and 18, or 19 and 20. Lower the 4-5 (bus) voltage until "X" and also "V" drop out. Then raise this voltage until "X" picks up again. This will check the bus voltage monitoring circuit. The setting can be adjusted by rheostat R3.

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With rated voltage on both sources lower the 6-7 (generator) voltage until "X" and "V" drop out. As the 6-7 voltage is lowered, the "R" unit will pick up at some point indicating that the bus voltage monitoring transistors Q3 and Q13 are turned on. Raise the 6-7 voltage until "X" and "V" pick up. This will check the generator voltage monitoring circuit. The setting can be adjusted by means of rheostat R11.

With rated voltage on 4 and 5 (bus) and 60 volts on 6 and 7 (generator) check that "R" is picked up. Raise the 6-7 voltage until L picks up. This will check the location and the width of the dead band where there is no voltage changing signals and synchronizing is permitted. The location of the dead band can be adjusted by means of rheostat R6 and R8. This location should be made with one of the rheostats set to provide zero resistance between the positive supply and the "S" relay coils. The width of the dead band is adjusted by means of the R7 rheostat.

\* If tests are being made on an SASB11B relay, the timing card should be checked. To check the pulse times move the connection on stud 9 to stud 10. With rated voltage on 4 and 5 (bus) and 60 volts on stud 6 and 7 (generator) raise the 6-7 voltage until "V" picks up. Continue to raise 6-7 voltage slowly until "V" begins to drop out and pick up. This voltage setting, which sets the point where intermittent voltage changing signals are given, is adjustable by means of the R21 rheostat on the timing card. With the 6-7 voltage a little above the point where the "V" unit provides an intermittent output, connect an electronic test timer to start when the circuit is broken between studs 11 and 12. This timer should be connected to stop when the circuit is subsequently made between studs 13 and 14. This is the "off" time and is adjustable by rheostat R23 on the timing card.

Reconnect the test timer to start when the circuit is made between studs 11 and 12 and to stop when the circuit is subsequently opened between studs 13 and 14. This is the "on" time and is adjustable by rheostat R22 on the timer card.

## SERVICING

For cleaning relay contacts a flexible burnishing tool should be used. This consists of a etched roughened strip of flexible metal resembling a superfine file which removes corroded material quickly without scratching the surface. The flexibility of the tool insures the cleaning of the actual points of contact. Never use knives, files, abrasive paper or cloth to clean relay contacts. A burnishing tool as described above can be obtained from the factory.

## RENEWAL PARTS

It is recommended that sufficient quantities of renewal parts be carried in stock to enable the prompt replacement of any that are worn, broken or damaged.

When ordering renewal parts, address the nearest Sales Office of the General Electric Company, specify quantity required, name of part wanted, and give the complete nameplate data. If possible, give the General Electric requisition number on which the relay was furnished.



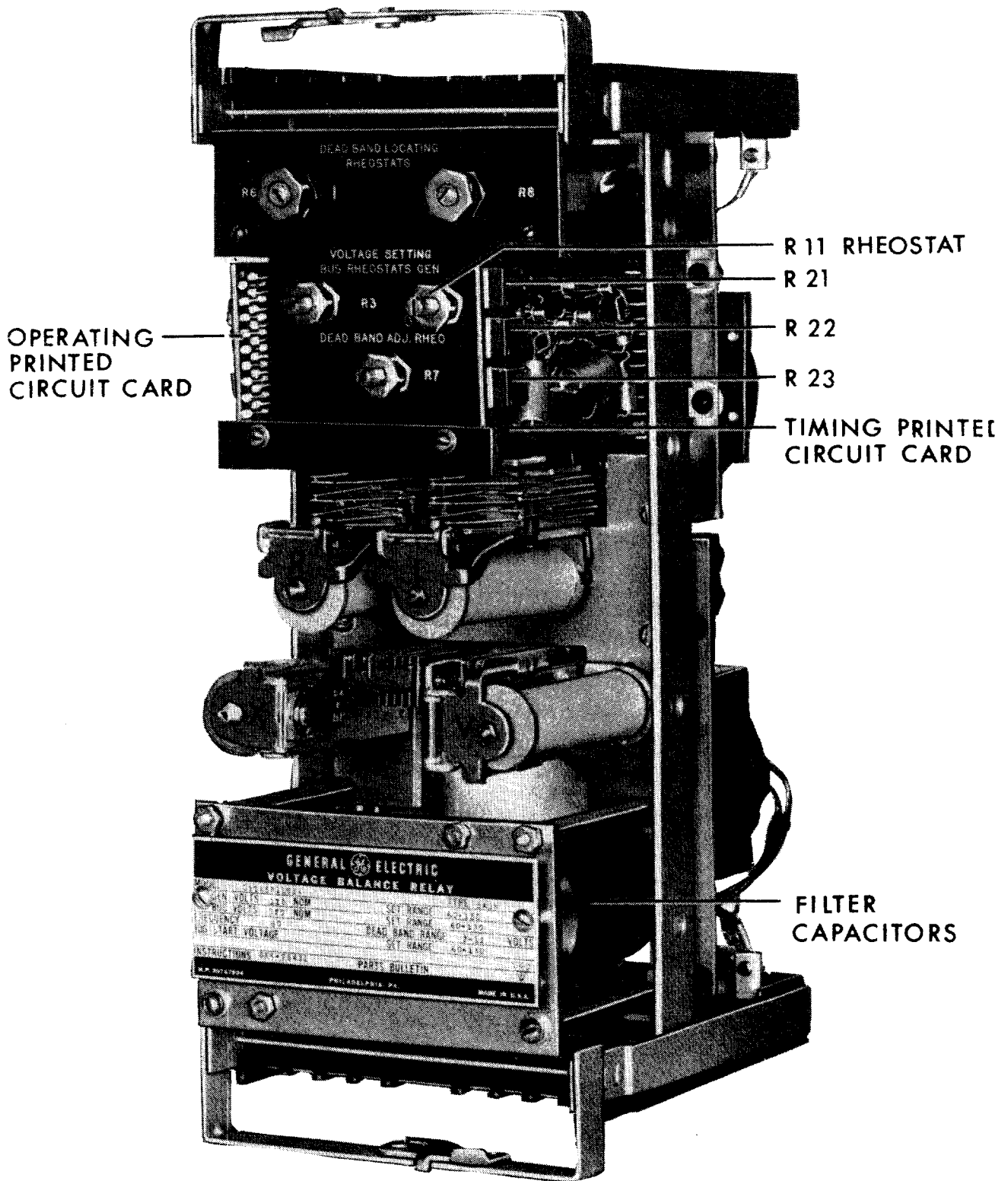


Fig. 1A (8039820) Type SASB11 Relay Removed from Case (3/4 Front View)

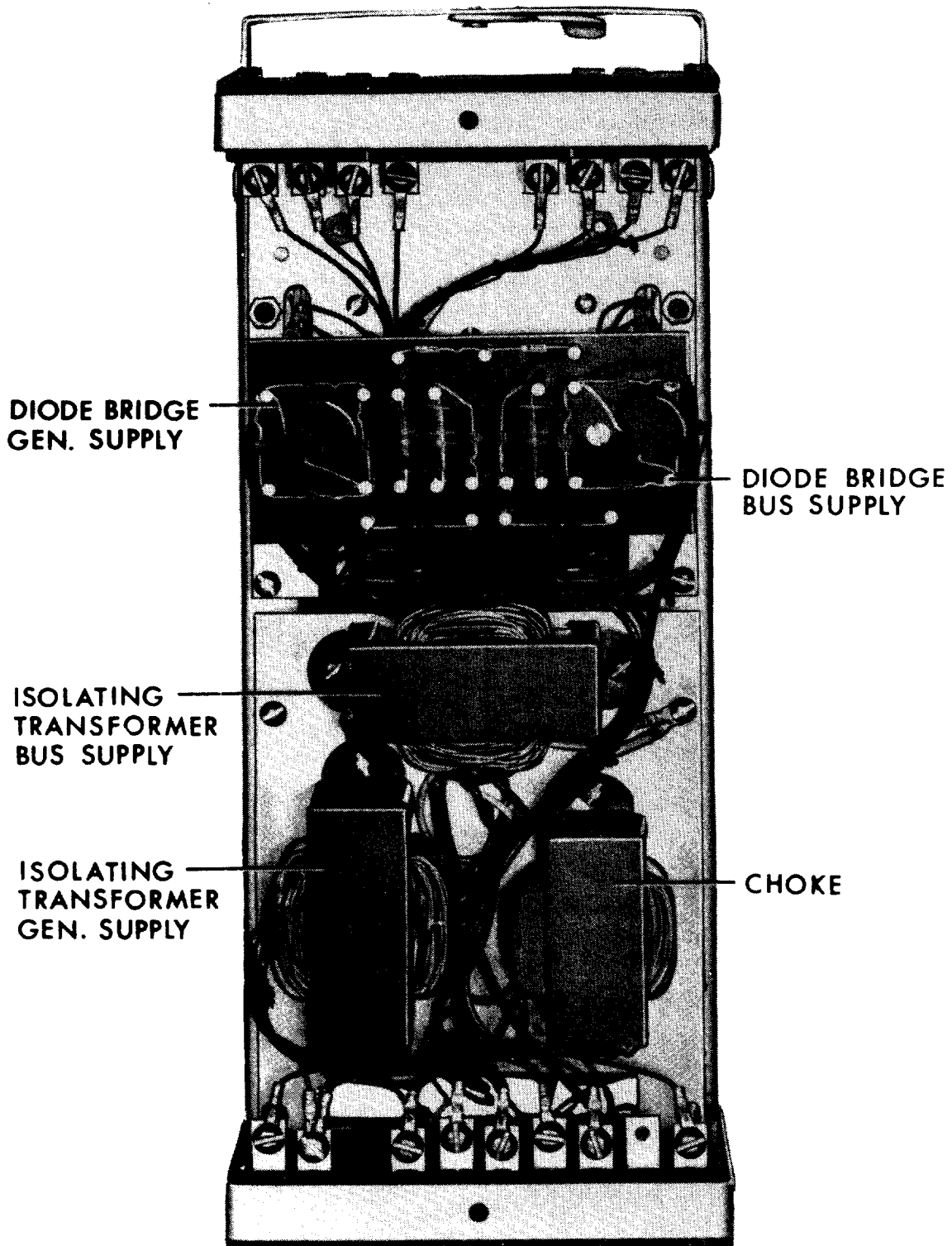
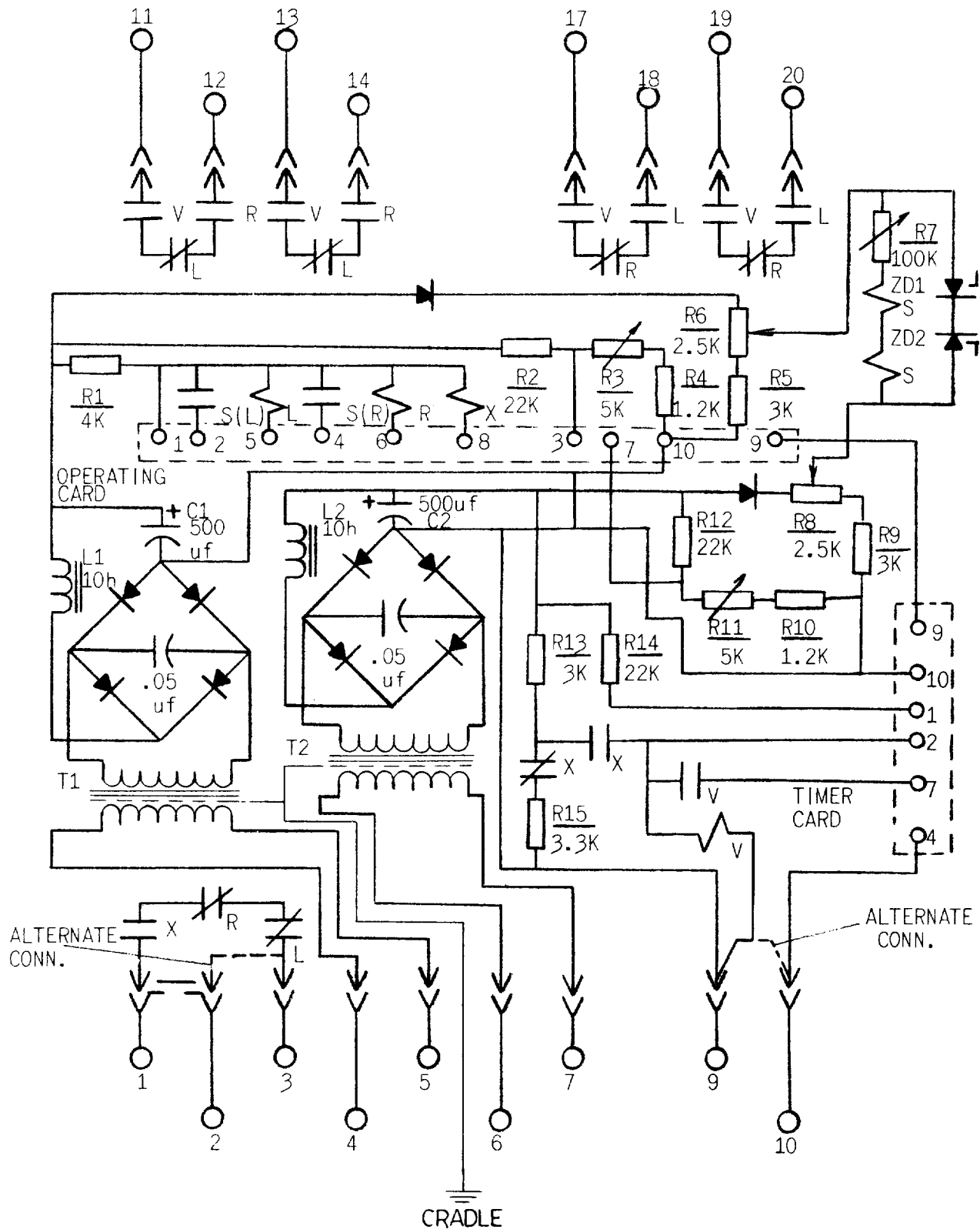
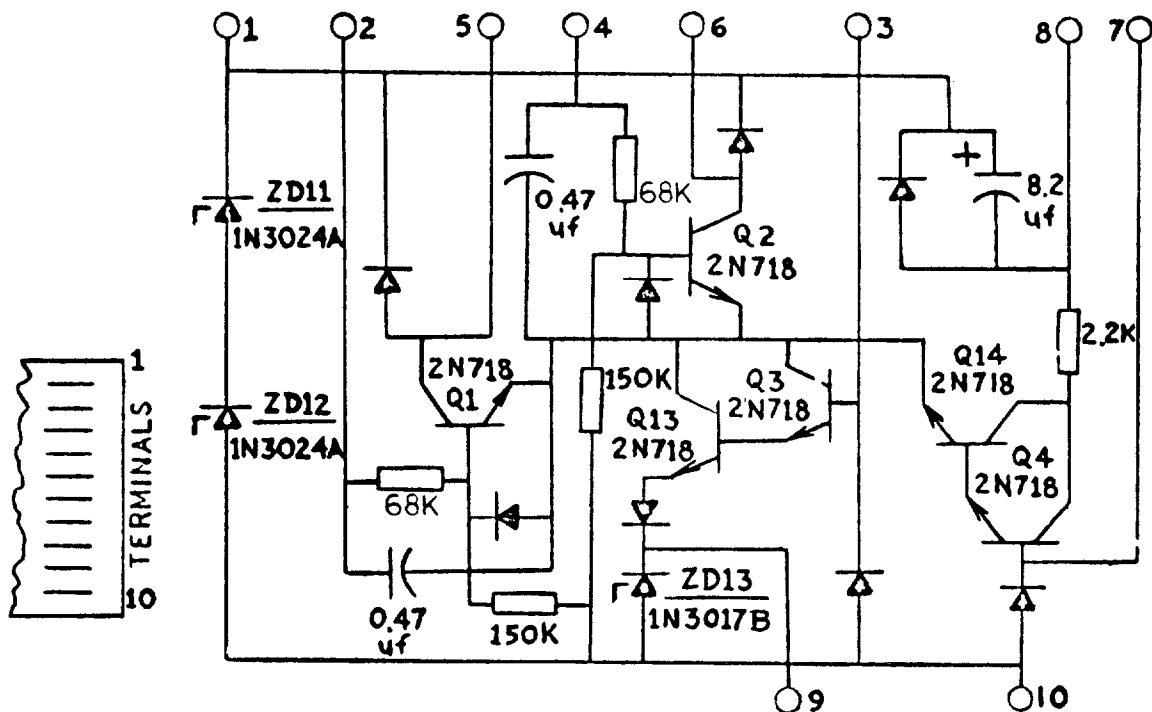


Fig. 1B (8039822) Type SASB11 Relay Removed from Case (Rear View)

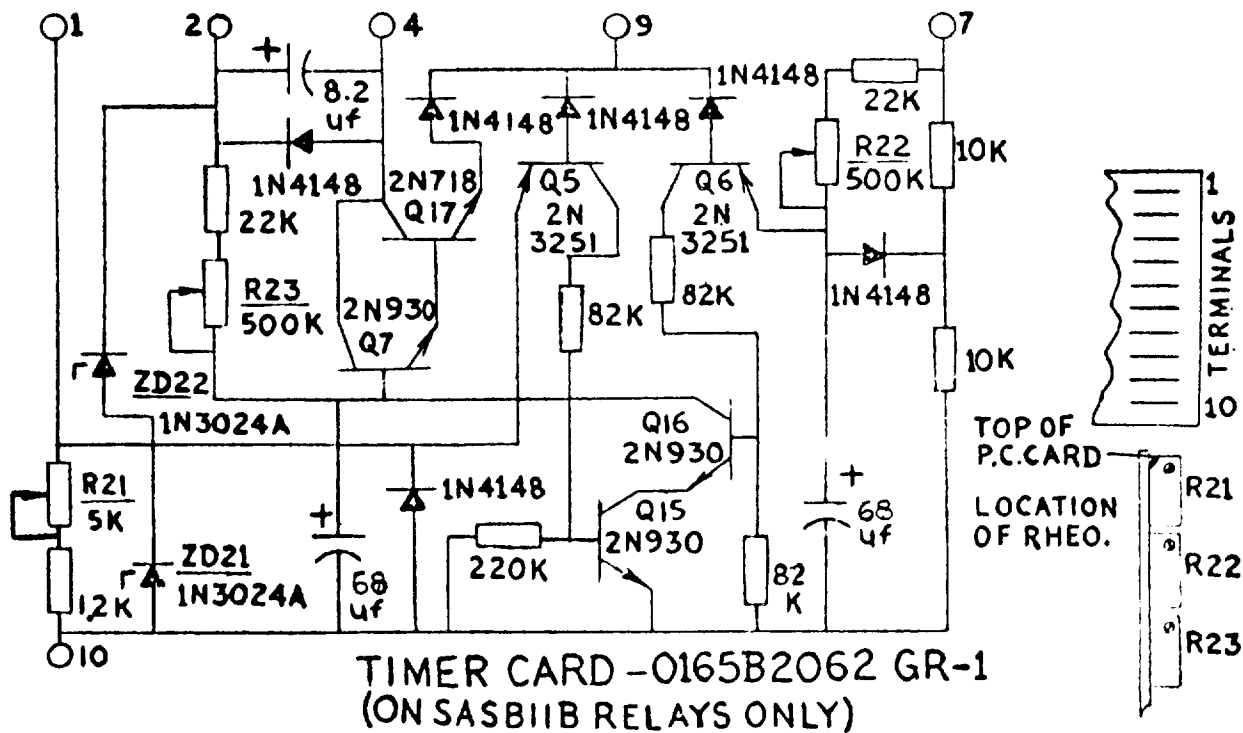


\* Fig. 2A (0208A2483-1) Sh. 1 Internal Connections Diagram for Relay Type SASB11 (Front View)

ALL DIODES ARE 1N4148 UNLESS NOTED

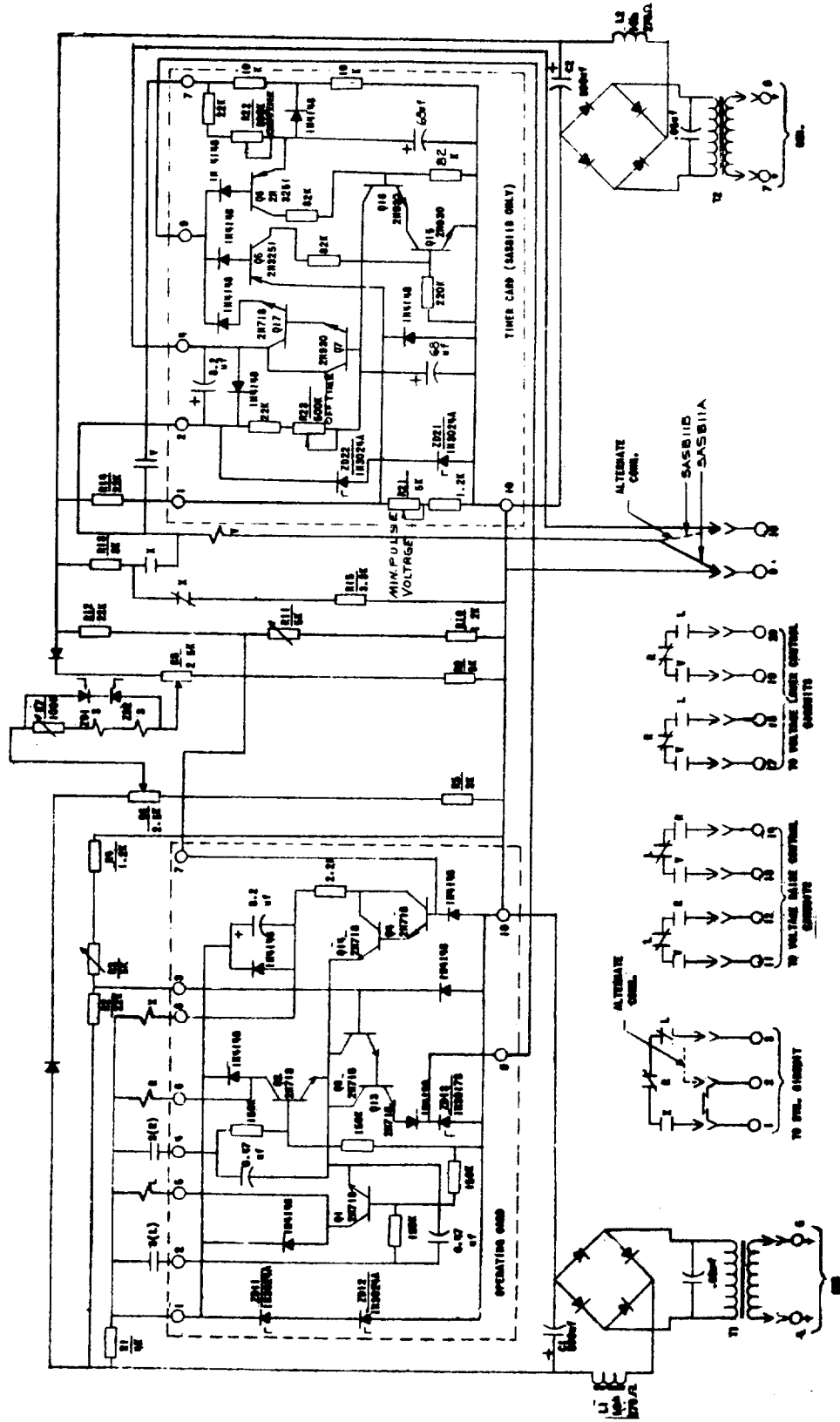


OPERATING CARD -0165B2060 GR-1



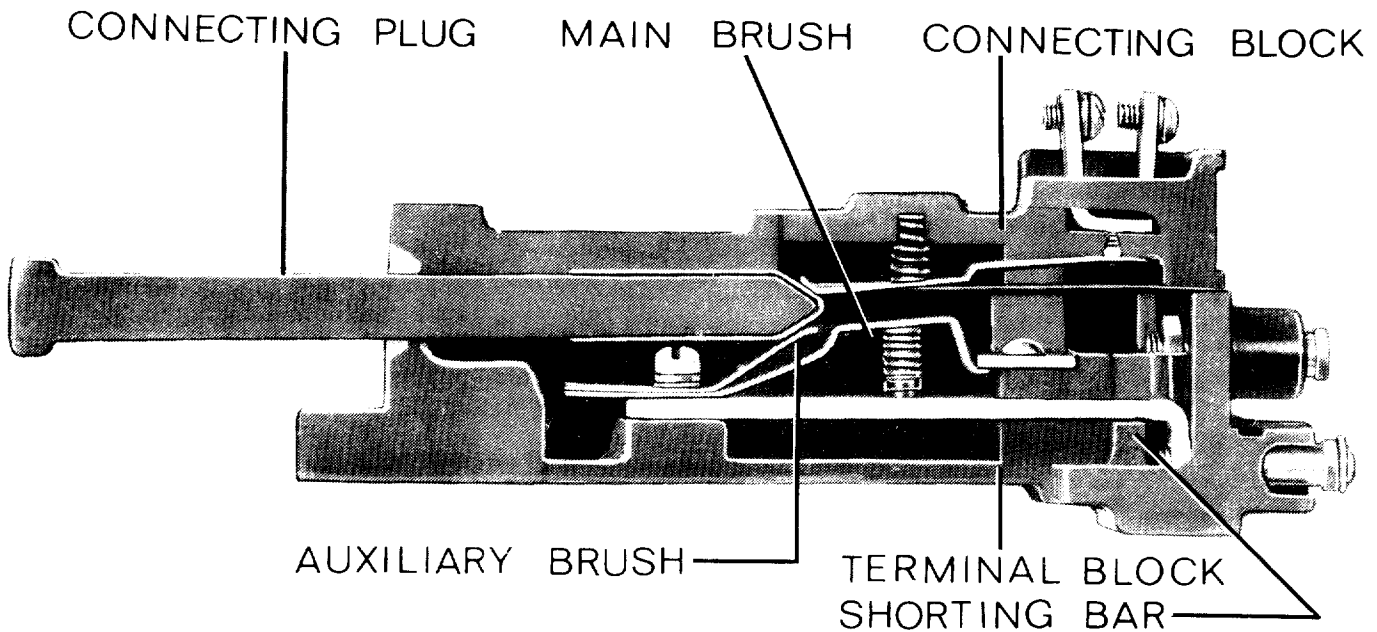
TIMER CARD -0165B2062 GR-1  
(ON SASB11B RELAYS ONLY)

\* Fig. 2B (0208A2483-3) Sh. 2 Internal Connections Diagram for Relay Type SASB11



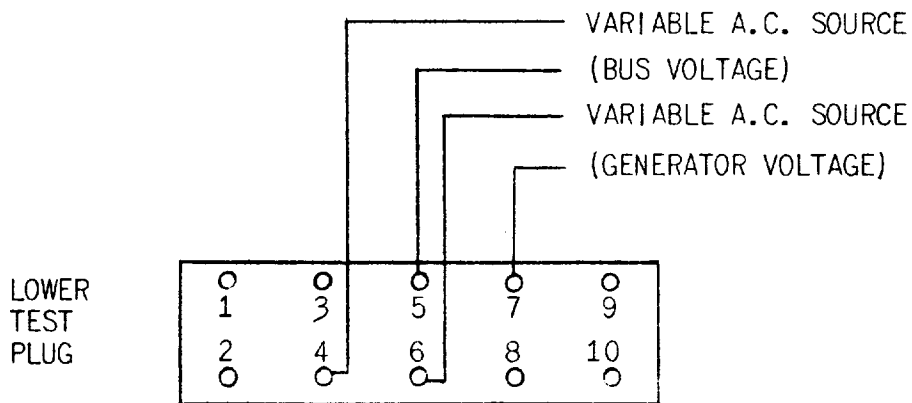
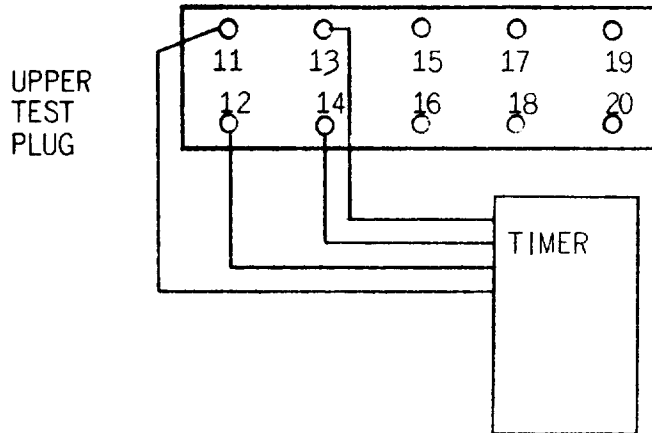
\* Fig. 3 (0164B9162-4) Typical Elementary Diagram for the SASB11B Relay

\*Indicates Revision



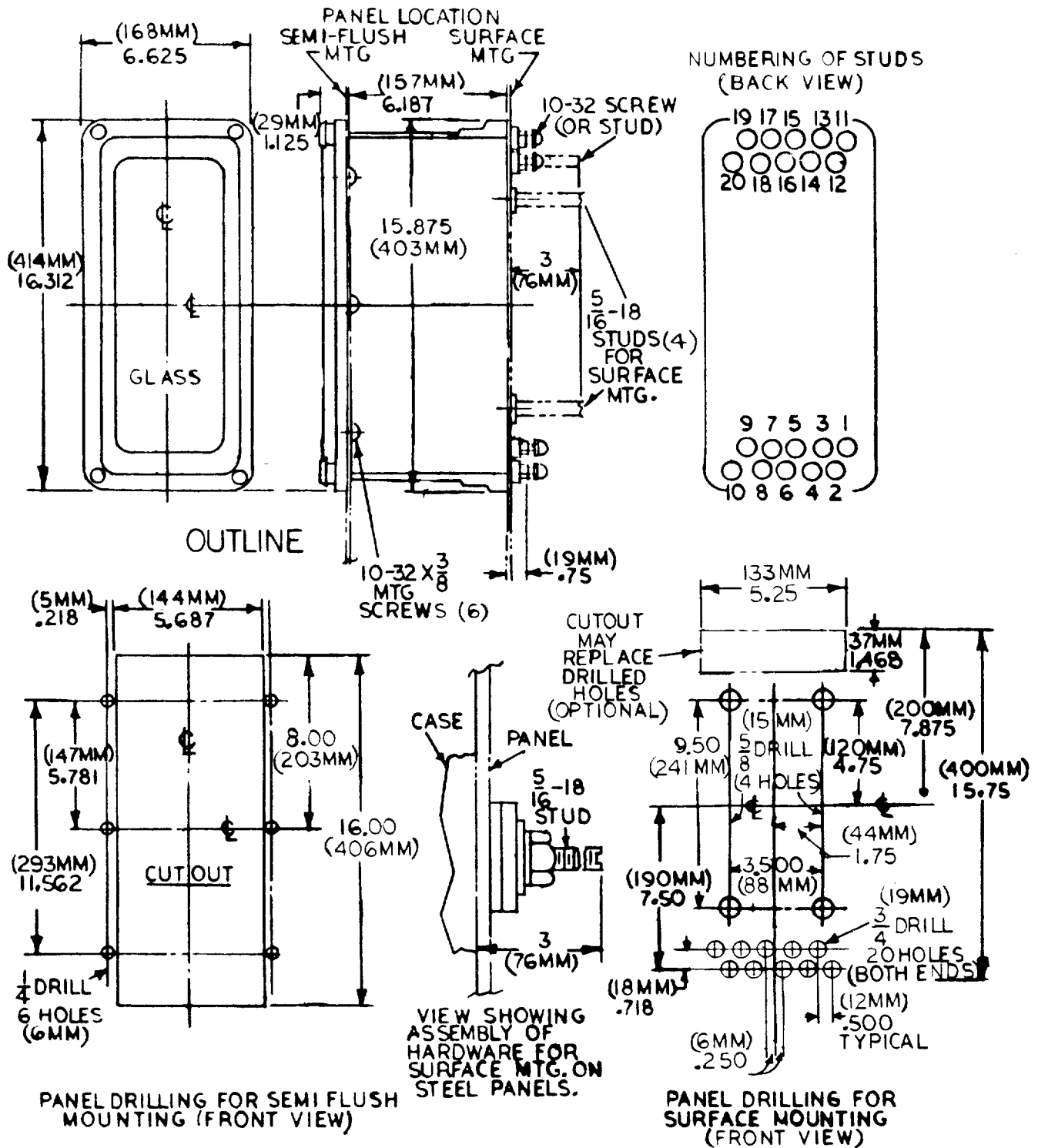
NOTE: AFTER ENGAGING AUXILIARY BRUSH CONNECTING PLUG TRAVELS  $\frac{1}{4}$  INCH BEFORE ENGAGING THE MAIN BRUSH ON THE TERMINAL BLOCK

\* Fig. 4 (8025039) Cross Section of Drawing Case Showing Position of Auxiliary Brush and Shorting Bar



FIELD TEST CONNECTIONS FOR THE SASB TYPE RELAY

Fig. 5 (0226A6925-0) The Field Test Connection Diagram for the SASB11 Relay



\* Fig. 6 (K-6209274-4) Outline and Panel Drilling Dimensions for Drawout Relays - Size M2

\*Indicates Revision

